benefit of others. Wyatt has set out some criteria for evaluating telemedicine as a new health care technique[20]

• *Understanding that telemedicine is not driven by technology*—Purchasing the equipment will not guarantee success (any more than buying a scalpel will turn you into a surgeon).

It cannot be overemphasised that simply buying the box won't enable you to practise successful telemedicine. In this respect certain commercial companies are doing the medical profession a grave disservice by implying that, say, videoconferencing equipment is all that is required for telemedicine. The NHS has an unfortunate history of introducing information technology, and parts of the country have been littered with the Ozymandian carcasses of past "initiatives" at huge expense to the tax payer. Successful telemedicine requires not only the right equipment but, perhaps more important, a change in the way that medicine is organised and services are contracted for. For example, it may be necessary to develop a mechanism for reimbursement of telemedicine episodes.

The future

Telemedicine is here to stay and is likely to play an increasing role in future health care.[1] Pressure from patients, and an increasingly litigious environment, make it important that in cases of doubt an appropriate professional opinion is sought. Telemedicine offers a method of seeking that opinion quickly and cheaply, thus providing a solution to an increasing problem in the delivery of health care.

If telemedicine were to be adopted widely, it might have a considerable impact on the NHS. In areas where it was shown to be cost effective, which are likely to include particularly the interface between primary and secondary care, it would facilitate the decentralisation of healthcare delivery. This might increase the pressure at district hospital level. However, it should not be viewed as posing a threat to specialist hospitals—rather the reverse, since telemedicine offers a mechanism for exporting their expertise (for money) further down the healthcare pyramid.

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Can telemedicine be used to improve communication between primary and secondary care?

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Abstract

***Objective*—To test feasibility and acceptability of teleconferencing routine outpatient consultations.**

***Design*—Exploratory trial of teleconferenced outpatient referrals of general practitioners.**

***Setting*—An inner city teaching hospital and surrounding general practices.**

***Subjects*—Six general practices linked to hospital outpatient clinics.**

***Main outcome measures*—Levels of participants' satisfaction measured with self administered questionnaires.**

***Results*—54 teleconsultations were performed in 10 different specialties. Few serious technical problems were encountered, and high levels of satisfaction with the consultations were reported by patients, hospital specialists, and general practitioners.**

***Conclusions*—Teleconferenced consultations for routine outpatient referrals with joint participation of general practitioner were feasible. These may have an important potential benefit for improving communication between primary and secondary care.**

Introduction

Problems in communication between hospital specialists and general practitioners are a well documented feature of the interface between primary and secondary care, especially in inner city areas.[1] Written communications have been shown to be of variable quality[2 3] and are often of poor educational value.[2 4] The need for improved communication between hospitals and community care has been recognised by the NHS as a priority for its research and development programme.[4]

There are several ways in which communications between primary and secondary care may be improved, such as the more effective use of telephones, outreach clinics, and greater use of joint domiciliary visits. There is evidence that some general practitioners and specialists make extensive use of the telephone, but in general it is not used a great deal and programmes to increase its use have not proved successful.[5] There has been a major expansion in the use of outreach clinics, in which consultants see patients in a general practice setting, but current evidence indicates that these do little to improve interaction between general practitioners and specialists.[6] They are also expensive in consultant time. Domiciliary visits are now uncommon apart from in medicine of old age and psychiatry. They are also costly

(in 1988 they cost an estimated £20 000 000 in consultants' fees alone) and generally fail to bring hospital specialists and general practitioners together in a joint consultation.[7 8]

A study of joint orthopaedic consultations, in which specialists and general practitioners reviewed patients together, found that joint consultations of this kind could lead to substantial educational gains for the participating doctors, together with improved patient welfare and more efficient use of the health service.[9] The main problem with this type of consultation is the requirement for the hospital specialist or general practitioner, or both, to leave their usual place of work. Teleconferencing offers a solution to this by using a video link to obviate the need for travel.

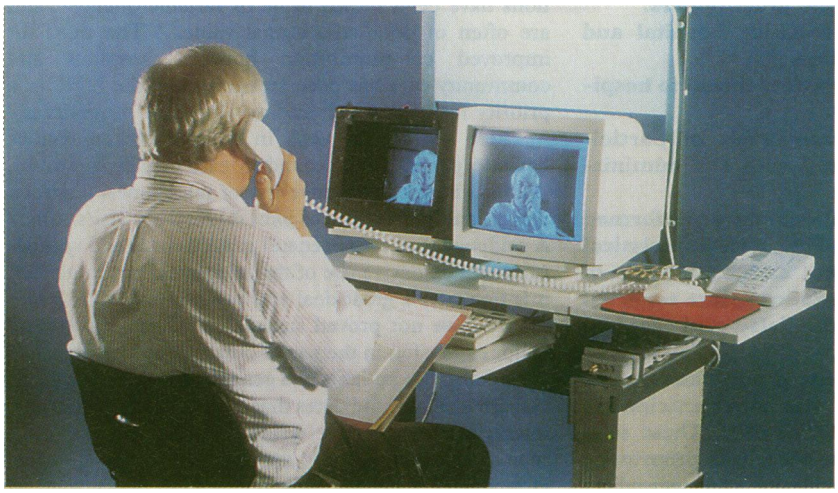
Although telemedicine has experienced a number of false dawns,[10] there are now converging economic, technical, and political trends that make expansion of its role likely. The cost of basic videoconferencing technology is falling. Standards set by the telecommunications industry are achieving conformity, and, with the advent of digital transmission, effective channels are available through existing telephone and cable networks. In the NHS investments in the national NHS-wide electronic network, the uniform patient number, and electronic medical records show a commitment to using effective electronic linkage.

To evaluate the potential benefits of joint teleconsulting we undertook a feasibility study using a standard, commercially available videoconferencing package and telecommunication links. An additional aim of our study was to examine to what extent it might effectively be used as an alternative to outpatient referral and to obtain an indication of its acceptability to all the parties involved.

Subjects and methods

After informal discussions and interviews, six general practices were selected to have access to 10 hospital specialists based at the Royal Free Hospital, London, for scheduled teleconsultations. The specialties were dermatology; endocrinology; ear, nose, and throat; gastroenterology; gynaecology; oncology; orthopaedics; paediatrics; psychiatry; and urology. We used semi-structured interviews to determine the expectations of potential participants and to identify criteria for successful consultations.

The specialists and general practices were equipped with a standard commercial videoconferencing equipment for desktop PCs (British Telecom VC 8000). This consisted of Screencall software, a card to go inside the computer, a telephone handset, and a small video camera that could be mounted on the top or side of a computer monitor. A mobile unit was developed for the consultants. This included a special camera-screen interface to enable better eye to eye contact with the patient. The equipment was linked through Integrated Service Digital Networks (ISDN) lines to allow simultaneous live audio and video transmissions with a basic overall quality.



Workstation used to provide teleconferencing by hospital specialists

Table 1—*Views of general practitioners and specialists who participated in 54 teleconsultations*

Statement	No (%) of doctors who agreed or strongly agreed with statement: General practitioners (n = 43)	Specialists (n = 48)
Communication was adequate	42 (98)	41 (87)
Information I obtained was adequate	40 (93)*	43 (94)
Rapport with the patient was good	39 (93)*	42 (89)
I was satisfied with the patient's response	40 (95)	41 (87)
Quality of the sound was satisfactory	35 (81)	26 (54)
Quality of the vision was satisfactory	34 (79)	26 (54)
Overall quality of the telelink was good	39 (91)	32 (68)
Arrangements worked well	40 (93)	41 (85)

*Not all questions were answered in each completed questionnaire.

Access to the service was through a direct line to the research office, from where the administrator arranged the appointments. There were no formal criteria for the selection of cases during the feasibility trial: general practitioners were free to refer as they wished to the specialties in the study (if the participants were dissatisfied it was always possible for the patient to attend the hospital). The joint teleconsultations were achieved through arranging an appointment time convenient for the patient, general practitioner, and specialists.

After each consultation, all three participants completed a self administered questionnaire. Questions were designed to measure satisfaction with the quality of the consultation and the technical and administrative performance by means of five point, Lickert-type scales. The perceived reason for the consultation and the outcome were also requested. Consultants were asked to record whether they regarded the referral as appropriate, also with a five point scale. A framework for an economic appraisal was also developed.

Results

A total of 54 teleconsultations were booked and conducted over a period of five months. The research office was notified of one refusal. Five of the six general practices with access to the system participated. The practice that did not participate was atypical from in that it was a fundholder outside the catchment area of the Royal Free Hospital. All the general practitioners who tried the system had at least one successful teleconsultation.

TECHNICAL FEASIBILITY

Four of the early consultations were subject to serious technical failure, such as loss of sound or vision, or both. The images were not adequate for the dermatologist. Apart from those referred to dermatology, the patients had conditions that could be dealt with on the basis of their history, test results, and, occasionally, a visual examination. This usually required patients to show the distribution of their symptoms or the range of movement of joints. In one case the endocrinologist asked a patient to drink a glass of water in order to examine a goitre. The quality of the images were found to be satisfactory for these purposes.

PARTICIPANTS' SATISFACTION

The self administered questionnaires were completed by 43 (80%) of the patients, 43 (80%) of the general practitioners, and 48 (89%) of the consultants.

Doctors' satisfaction—Table 1 shows the levels of satisfaction reported by the general practitioners and consultants. Both groups of doctors generally recorded positive responses for all of the items used in the evaluation. The consultants were somewhat more critical of the technical performance, rating both sound and vision positively in only 54% of evaluated consultations. However, they expressed higher levels of satisfaction with the level of communication and information received. The consultants classified 44 (92%) of the referrals as most certainly or certainly appropriate. No referral was classified as inappropriate.

Patients' satisfaction was measured in both general statements and through specific parameters such as rapport, shyness, and confidentiality. The two overall measures were the patient's general satisfaction rating and their willingness to teleconsult again (tables 2 and 3).

Discussion

As far as we are aware, this is the most comprehensive reported study of participants' views of teleconsulting to date. Previously published studies of teleconsulting have, except for one study, examined only the patients' responses.[11-13] Our study has shown that the teleconferencing of outpatient referrals, with the joint participation of the general practitioners and hospital specialists, was feasible and acceptable to all parties involved. The satisfaction ratings recorded by all three groups of participants were consistently favourable and provide strong evidence that, for certain categories of referrals, joint teleconferenced consultations may be an appropriate alternative to routine outpatient visits.

FEASIBILITY OF TELECONSULTATIONS

The use of teleconferencing did not pose substantial technical problems. While the areas that received the least positive appraisal were technical performance and administrative arrangements, it must be appreciated that all the participants were novices with the technique. It is likely that increased practice and training would result in greater skill. Clear reasons were identified for the negative technical scores, such as too poor an image. The dermatologist's dissatisfaction with the quality of the images was in part due to the financial constraint placed on the technical investment in the practices, the level of skill of the users, and the limitations of current "off the shelf" software.

Other negative scores were due to administrative problems such as missing medical records. The relatively poorer ratings on technical performance by consultants is probably because they placed greater demands on the technology, which had to provide them with adequate sound and vision. Also, the general practitioners and patients usually used the equipment in "hands free" mode, which reduced the quality of the sound received by the consultant.

While there was scope for technical improvement, the basic quality of the audio-visual link did not seem to inhibit satisfactory consultations, providing a link was successfully made. Moreover, the collaboration needed to overcome any practical problems during the consultation seemed to increase the rapport between the participants. Most of the technical difficulties would be readily resolvable with improved software and a relatively inexpensive upgrade in telecommunications.

DRAWBACKS OF TELECONSULTATIONS

The inability of consultants to perform a physical examination may be perceived as a drawback for teleconsulting. In our study, however, some physical examinations did occur. These were visual examinations of patients, usually involving their demonstrating the problem or site of complaint. In some cases an examination by proxy was performed, with the general practitioner being guided by the consultant. In one case the ear, nose, and throat surgeon requested an appointment with the patient for direct visual inspection of their nasopharynx. With an appropriate level of investment—for example, in fibreoptic instruments—this could be achieved from the general practitioner's surgery.[14]

Concern has been expressed about legal liability and teleconsultations. Essentially, there is no difference between a teleconsultation and a conventional outpatient referral.[15] The onus is on the general practitioner and the consultant to make clear who is taking responsibility. Contemporaneous written records are required as for the usual type of referral.

Teleconsulting does create logistical problems in that all parties have to be present at the same time. This was manageable in our small scale trial, but it would undoubtedly cause greater difficulties if a service was introduced on a larger scale. Preliminary experience indicates that there may be a feasibility ceiling of two to three teleconsultations a week for a general practitioner. This would, however, represent a large proportion of suitable referrals, as teleconsulting would not be appropriate for all referrals. This level of teleconsulting could be of considerable educational value, and the possibility of teleconsulting being made eligible for the post graduate educational allowance are being explored.

Joint consultations may involve more general practitioner time. Research indicates, however, that there are fewer return visits to the general practitioner after a joint consult.[9] Our own study was too short to register any possible changes in referral behaviour. For patients, the reliability of appointment times is likely to be a considerable improvement on conventional outpatient clinics.

It is encouraging that the teleconsultations in our study could be accomplished effectively with relatively low level equipment based on desktop PCs in the doctors' usual workplace. The expected development of multimedia electronic record systems and the NHS-wide electronic network make it likely that the quality of, and access to, teleconsultations will improve.

LIMITATIONS OF STUDY

While our preliminary study showed teleconsulting to be feasible and acceptable, the viability of this particular form of telemedicine is not yet proved and there are several

Table 2—*Views of 43 patients who participated in teleconsultations*

Statement	No (%) of responses to statement		
	Positive	Neutral	Negative
After using the television link this is how I would feel about using it again	36 (84)	7 (16)	0
In general I felt my experience of using the television link was	41 (95)	0	2 (5)

Table 3—*Views of 42 patients who participated in teleconsultations*

Statement	No (%) of responses to statement*		
	Agree	Neither	Disagree
I felt the consultant could understand my problem	36 (86)	2 (5)	4 (10)
I was able to say all I wanted	36 (86)	1 (2)	5 (12)
I was worried others might be listening	3 (8)	6 (15)	31 (78)
I felt shy and nervous about speaking	8 (21)	3 (8)	29 (73)
I could not say all I wanted	8 (20)	1 (3)	32 (78)

*Not all items were completed and some replies were ambiguous, so that total No of responses not always 42.

Key messages

- Recent research shows that improved communication between doctors in primary and secondary health care in the form of joint consultations improves the quality of health care, is of educational value, and leads to a more economic use of health services
- Teleconferencing would allow doctors to achieve joint consultations through sound and video links without having to leave their usual workplace
- In our preliminary trial we used low cost, PC based, videoconferencing equipment to connect six general practices to 10 specialties in a hospital
- Few serious technical problems were encountered, and high levels of satisfaction were reported by the patients, hospital specialists, and general practitioners who participated in the consultations
- The feasibility of teleconsultations should now be tested in a full scale trial

factors which limit the conclusions that can be drawn from the study. The sample of general practitioners and hospital consultants is unlikely to be representative of the profession as a whole. Selection bias was strongest among the general practitioners, who were self selected enthusiasts. The initial evaluation of technical innovation will almost always be with enthusiasts, but this is likely to influence the doctors' satisfaction rather than that of patients. The patients who took part were largely unselected, with only one refusal to participate being reported by the general practitioners.

A larger, more rigorous study will be needed to evaluate this use of innovative technology. This will require a properly designed randomised control trial of adequate size and incorporating appropriate outcome measures. A pilot study of such a trial is currently in progress.

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Commentary: Telemedicine trials—clinical pull or technology push?

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Telemedicine—remote consultation via an electronic link—is now feasible and increasingly easy to realise. But is it necessary for patients, doctors, or the health service? Randomised trials of telemedicine were first performed two decades ago,[1 2] but some recent studies seem to have been driven by technology push rather than clinical pull.[3-5] These studies give inadequate attention to three fundamental aspects of any trial: defining what is done, to whom it is done, and what is measured.[6]

Defining what is done

Doctors conducted remote consultations long before the advent of telemedicine by diagnosing a sick patient over the telephone or reviewing mailed histology slides. The unique feature of telemedicine is the fast two way electronic network that allows interactive communication such as video conferencing.[5] To show that telemedicine confers benefit we must compare electronic means for transferring information with the most appropriate alternative.[2] This means comparing teledermatology with a telephone discussion of mailed photographs or videoconferenced Doppler scanning with discussion about a video delivered by courier. Only then can we disentangle the unique effects of telemedicine from effects due to exchange of high resolution colour or moving images, which can easily be achieved without telemedicine.

To whom is it done?

Turning to the trial subjects, we should be suspicious of studies that rely on enthusiasts or volunteers, who may tolerate technical eccentricities that most doctors would not. Although evaluation by enthusiasts is a necessary first step, to estimate the general benefit of telemedicine we need randomly selected doctors and patients and statements of the overall recruitment and success rates.[7]

What is measured?

Telemedicine has many potential benefits and side effects, so trialists must make appropriate measurements. Consider a conventional specialist consultation. Apart from allowing more precise diagnosis because of access to hospital-only investigations or treatments, it also generates a detailed written report for the referring doctor. The meeting between specialist and patient informs the former about the patient's personality and the latter about the condition's aetiology, prognosis, and relevant treatments—leading to enhanced patient participation in decisions[8] and a placebo effect, accompanied by greater compliance.[9]

Some of this will be reduced by telemedicine, so we need to measure patient satisfaction, compliance, and outcomes. We must ask participating doctors if they feel less able to consider patients' preferences and measure

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